

| REPORT DOCUMENTATION PAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                                |                                      | Form Approved<br>OMB No. 0704-0188                |                                                           |
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| 1. REPORT DATE (DD-MM-YYYY)<br>04/11/2013                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             | 2. REPORT TYPE<br>Final Report |                                      | 3. DATES COVERED (From - To)<br>02/2012 – 09/2012 |                                                           |
| 4. TITLE AND SUBTITLE<br><br>LVBIED Barrier Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                                |                                      | 5a. CONTRACT NUMBER<br>DOTC-09-01-INIT030         |                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                                |                                      | 5b. GRANT NUMBER                                  |                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                                |                                      | 5c. PROGRAM ELEMENT NUMBER                        |                                                           |
| 5. AUTHOR(S)<br><br>Indra Nayee                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                                |                                      | 5d. PROJECT NUMBER                                |                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                                |                                      | 5e. TASK NUMBER                                   |                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                                |                                      | 5f. WORK UNIT NUMBER                              |                                                           |
| 6. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br>Subsystem Technologies, Inc.<br>410 Route 15 South, Wharton, NJ 07885                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |                                |                                      | 8. PERFORMING ORGANIZATION REPORT NUMBER          |                                                           |
| 9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)<br><br>US Army Armament Research, Development and Engineering Center<br>Picatinny Arsenal, Picatinny, NJ 07806                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                                |                                      | 10. SPONSOR/MONITOR'S ACRONYM(S)<br><br>ARDEC     |                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                                |                                      | 11. SPONSOR/MONITOR'S REPORT NUMBER(S)            |                                                           |
| 12. DISTRIBUTION / AVAILABILITY STATEMENT<br><br>Public                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                                |                                      |                                                   |                                                           |
| 13. SUPPLEMENTARY NOTES<br><br>None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                                |                                      |                                                   |                                                           |
| 14. ABSTRACT<br><br>The project involves developing a system which can be employed in theatre during current operations. The plan is to pursue three concurrent activities to provide vehicle arresting barrier solutions in the near, mid and far terms. The near term activity is designed to accelerate efforts which ARDEC is currently developing (M2 Vehicle Lightweight Arresting Device (VLAD) with Remote Deployment Device (RDD)). The mid term path indicates the evaluation of other off-the-shelf products alone, in combination with the nets, or in combination with each other. The far term plan is to develop a team that will look at new design concepts and test them to meet the need to stop heavy vehicles. The Artillery Design Team, Indirect Fire Division, W&T, WSEC is developing The LVBIED Barrier Project which addresses the capability gap of arresting a large vehicle born improvised explosive device traveling through an entry point. |             |                                |                                      |                                                   |                                                           |
| 15. SUBJECT TERMS<br><br>LVBIED (Large Vehicle Borne Improvised Explosive Device) Barrier Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                                |                                      |                                                   |                                                           |
| 16. SECURITY CLASSIFICATION OF:<br>N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                                | 17. LIMITATION OF ABSTRACT<br><br>UU | 18. NUMBER OF PAGES<br><br>5                      | 19a. NAME OF RESPONSIBLE PERSON<br>Indra Nayee            |
| a. REPORT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | b. ABSTRACT | c. THIS PAGE                   |                                      |                                                   | 19b. TELEPHONE NUMBER (include area code)<br>973.989.8001 |



# **Final Technical Status Report**

**For**

## **LVBIED Barrier Project**

**Initiative No: DOTC-09-01-INIT030**

**Reporting Period: January 2012 – September 2012**

### **Ordnance Technology Initiative Team**

**Subsystem Technologies, Inc.**

**Karco**

### **Initiative Team Technical POC**

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***Submitted: October 25, 2012***

## **1. Comments on Technical/Cost/Schedule Performance:**

The Artillery Design Team, Indirect Fire Division, W&T, WSEC is developing The LVBIED Barrier Project which addresses the capability gap of arresting a large vehicle born improvised explosive device traveling through an entry point. Design considerations include current requirements, but shall not be limited to: vehicle velocity, vehicle weight, ease of emplacement, emplacement time, lethality, stopping distance and must allow for selective interdiction of vehicles. The capability gap's objective requirement is to stop a vehicle traveling at 50mph and weighing 65,000 lbs.

The project involves developing a system which can be employed in theatre during current operations. The plan is to pursue three concurrent activities to provide vehicle arresting barrier solutions in the near, mid and far terms. The near term activity is designed to accelerate efforts which ARDEC is currently developing (M2 Vehicle Lightweight Arresting Device (VLAD) with Remote Deployment Device (RDD)). The mid term path indicates the evaluation of other off-the-shelf products alone, in combination with the nets, or in combination with each other. The far term plan is to develop a team that will look at new design concepts and test them to meet the need to stop heavy vehicles.

During this reporting period, we conducted the series of tests to assess the Delta Scientific DSC7000 Crash Barrier in a direct burial scenario using alternate foundation methods per the test plan agreed by Government. The DSC7000 was evaluated per the ASTM F 2656-07 "Standard Test Method for Vehicle Crash Testing of Perimeter Barriers" to the M50 Level. The intent of test M50 is to evaluate the ability of the test article to arrest a 6800 Kg (15000 lb.) vehicle from penetrating or vaulting a secured area such as ordnance storage, military base and the extent, if any, of barrier deformation.

Current tasks are on schedule and performing within the allocated budgets. The cost and schedule performance of this initiative meets the customer's requirements.

## 2. Initiative Quad Chart

| LVBIED Barrier Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Goals & Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Initiative Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p>The objective of this initiative is to design, analyze, develop, and perform the vehicle barrier test in accordance with the government specification. The support includes;</p> <ul style="list-style-type: none"> <li>• Perform testing and evaluation services</li> <li>• Supply all necessary facilities, materials and personnel to conduct a study to evaluate the MVB (Modular Vehicle Barrier) portable barrier capabilities and</li> <li>• Verify that the MVBs meet the threshold requirements to stop ramming vehicles</li> <li>• Stop a vehicle traveling at 50mph and weighing 65,000 lbs. by developing a system which can be employed in theatre during current operations.</li> </ul> | <p><b>Initiative Lead:</b> Subsystem Technologies, Inc<br/> <b>Team Members:</b> Karco<br/> <b>Period of Performance:</b> February 2012 – September 2012</p> <p><b>Initiative Modifications:</b><br/> Mod 1 updated period of performance (through April 2012)<br/> Mod 2 Amendment<br/> Mod 3 updated POP (Through September 2012)</p>                                                                                                                                                                                                                                                                                                                                                                  |
| Milestones & Technical Achievements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Implementation & Payoff                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p>July 13: Status update meeting<br/> August 16: Data Exchange Meeting<br/> August 30: Test report review<br/> September 20: Status Update Meeting</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>Schedule:</b> The tests were conducted as planned.<br/> <b>Status:</b> Cost and schedule performance of the initiative meets the customer's requirements</p> <p>Successful completion of tests will provide the evaluation of prototype arresting barrier in the effort of enhancing the state-of-the-art methods to stop VBIED (Vehicle Born Improvised Explosive Devices). In order to meet the increasing demands from threats by large vehicles carrying improvised explosive devices and acting as missiles targeting our soldiers at checkpoints and in the field, study will quantify the improvements (reduce collateral damage, and improve barrier effectiveness) necessary per SOW.</p> |
| <p><b>Current Status:</b> Technical = Green/Yellow/Red (delta)    Schedule = Green/Yellow/Red (delta)    Cost = Green/Yellow/Red (delta)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

**Current Status Legend:**    Green = Good/On Budget    Yellow = Minor Weakness/Known Risk    Red = Major Weakness/Critical  
Delta: ⬆ = upgrade from last assessment; ⬇ = downgrade from last assessment; ⇌ = no change

### 3. Supplemental Information

The following sections summarize the activities for this quarter:

#### 3.1 Technical Achievements

SUBSYSTEMs successfully completed the tests in accordance with the Statement of Work.

##### 1. Vehicle Preparation:

The vehicle was weighed and ballast to the proper test weight for the test specified. The vehicle was measured for crush characteristics and instrumented with the on-board data acquisition system and accelerometers to measure dynamic forces during impact event. A remote controlled braking system was installed in the vehicle for safety.

##### 2. Pre-Test Set Up

We installed the barrier at the crash area to meet the designated impact angle and roadway characteristics. All instrumentation and photographic equipment were pre-tested and calibrated. The test set up was performed as listed below:

- Vehicle test in accordance with ASTM M50 and reporting
- Installation and removal of test article and returning test site to pre-test condition
- Backfill soil (gravel and sand)
- Vehicle test vehicle procurement in accordance with ASTM M50
- Soil test for base material and final installation
- Vehicle Disposal

##### 3. Test

The test was conducted in accordance with the specified test criteria for each vehicle arresting barrier test. Post-test measurements were made and the pass/fail criteria evaluated. The data was processed and plots were recorded for each channel of data collected. Dynamic intrusion was verified from the high-speed video coverage.

##### 4. Post-Test Measurement

We performed the post-test measurements consist of visual inspections assessing the level of damage to the test sled article. Additionally, disbursement distances of various parts broken away from the test sled were quantified by measurements related back to the point of impact.

##### 5. Test Reporting

Our team acquired the data for each test comprised of the pre-test and post-test inspection and measurements listed in the test procedure, real-time and high-speed video of the impact event, color photographs of pre- and post-test set up, impact velocity measurements, force measurements acting on the test vehicle, and any other data requested. The high-speed video coverage was selected to best document vehicle and barrier kinematics. Impact velocity was accurately measured to 99.9999 per cent accuracy by utilizing a photoelectric speed trap positioned to record velocity within one foot of the impact. The speed traps that were used contained two sets of photoelectric sensors and light sources, interfaced to two time interval meters providing five digit microsecond displays at a 1 MHz clock rate, with accuracy of 0.05%,

traceable to the National Institute of Standards and Technology. The final report was provided to the government on March 20, 2012.

#### **Milestone Status:**

| <b>Mile-stone No.</b> | <b>Deliverable Description</b>               | <b>Due Date</b> | <b>% Complete this period</b> | <b>Cumulative % complete</b> |
|-----------------------|----------------------------------------------|-----------------|-------------------------------|------------------------------|
| 1                     | Test Plan                                    | 02/01/2012      | 100%                          | 100%                         |
| 2                     | Test Run 1,2 & 3                             | 02/21/2012      | 100%                          | 100%                         |
| 3                     | Test 4 (Alignment Test)                      | 02/28/2012      | 100%                          | 100%                         |
| 4                     | Quarterly Technical & Business Status Report | 03/20/2012      | 100%                          | 100%                         |
| 5                     | Final Technical & Business Status Report     | 09/30/2012      | 100%                          | 100%                         |

#### **Technical Readiness Level Status: Not applicable**

#### **3.2 Problems Encountered and Action Taken**

- *Changes to the initiative objective or schedule:*  
No changes to the initiative objective or schedule were encountered. The period of performance was extended until April 2012 to meet the additional task requirements.
- *Technical problems and approach to correct:*  
There were no technical problems encountered during this reporting period.
- *Schedule problems and approach to correct:*  
There were no schedule problems reported.
- *Risks identified and mitigation plans:*  
There were no identified risks during this reporting period.

#### **3.3 Technology Transfer**

- No technology transfer identified during this reporting period other than the successful completion of all tests.

#### **3.4 Plans for Next Quarter**

- Not applicable